

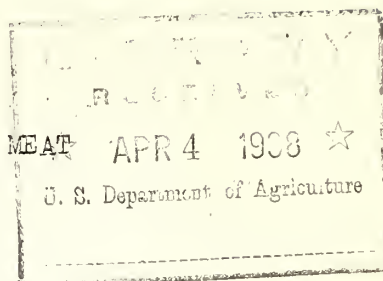
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United States Department of Agriculture
Bureau of Animal Industry
Animal Husbandry Division

COLD STORAGE LOCKERS FOR PRESERVING FARM-DRESSED MEAT

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A cold storage locker is a "safety deposit box" kept in a room with a temperature near zero Fahrenheit where families may freeze and store food supplies that have been grown at home or bought. Meats, poultry products, butter, fruits, and vegetables are stored for as long as a year in the hundreds of locker units that are now in operation chiefly in the Pacific Northwest and in the Corn Belt. These lockers, of around 250 pounds capacity, rent for some \$10 per year with an additional service charge for cutting, wrapping, and freezing of about one and one-fourth cents per pound of product.

Cold storage lockers are but another of the natural steps in the progressive task of bringing refrigeration closer to the farm home. The widespread distribution of electrical power, new developments of mechanical equipment, and improved cold storage service have made possible the local use of these controlled temperatures by farmers.

Seldom has any new development caught on so rapidly and created so much interest in its use, influence, and future as has the cold storage locker. Practically unknown five or six years ago, these locker units have been reported in operation in 21 States and many inquiries have been received concerning them from all the other States. Are they practical? What type of construction and methods of operation are recommended? What is the cost? To suggest answers to these questions and to supply the information that will help this new type of middleman, the seller of low temperatures, to give the results that the buyers of that service need, is the purpose of this paper.

Cold storage lockers give real service in many communities. It must be remembered, however, that such lockers have both their advantages and their limitations, their justified costs and their promotional dangers. The chief purpose of a cold storage locker is to help supply farm families with an adequate diet. To be adequate that diet must be ample, so that all can have enough; varied, so that all can have sufficient quantities of the proteins, minerals, vitamins, fats, and other nutrients that the body needs; palatable, so that folks will enjoy eating it; and economical, so that they can afford it. Moreover, that food supply must be ample, varied, palatable, and economical at all seasons of the year. If a cold storage locker can make available a greater variety of palatable fresh foods, including fresh meat, it contributes a desirable supplement to the salted and canned foods now largely used by families who are trying to preserve an adequate supply of home-raised products. A cold storage locker will give service to the extent that it can increase the healthful variety and quality of foods available and decrease the need for cash to purchase the family's needs.

Effects of Freezing

Satisfactory results from storing foods in freezer lockers depend upon the original quality of the foods, the methods by which they are prepared and stored, and the length of time they are kept in storage. Freezing tends to fix or hold the quality of a food in the same condition that it possessed when frozen. Only fresh, clean, wholesome, palatable products deserve the trouble and expense involved in freezer storage.

Undesirable changes can occur in frozen foods unless proper methods of preparation and storage are used. Freezing serves (1) to kill or stop the growth of molds, yeasts, and bacteria, (2) to inactivate the enzymes, thus delaying autolysis or self-digestion, and (3) to retard chemical changes such as dehydration and oxidation. Although there is little microbial action under commercial freezer storage, the development of undesirable flavors, odors, textures, and colors is not uncommon. These changes are attributed to continuing action of enzymes, evaporation of the surface ice, etc. More information is needed as to the most favorable conditions and methods for handling these various products, but the following procedures are reported to give reasonably satisfactory results.

Preparing Meat for Freezing

All meats should be from healthy animals that have been dressed in a proper and sanitary manner. Clean meat keeps better than that which has been soiled and contaminated in handling or hauling.

Freshly slaughtered meat should be chilled promptly to a temperature just above freezing, within 24 hours if possible. Pork is usually cut and frozen shortly after it is chilled but beef and lamb will be more tender if hung or aged at temperatures between 33° and 38° F. for a week or ten days before it is cut and frozen. The relative humidity of the chill room is usually held at 80 to 90 percent.

Cut the chilled carcass in accordance with the quantity and size of roasts, steaks, pot roasts, and ground meat that the family desires. Frozen meat is difficult to cut. If the beef is from a good-quality, well-fed, relatively young animal the family will enjoy some of the ripened loin steaks that have been cut an inch or inch and a half in thickness. Real thin steaks, such as are often cut from the round, dry out too much if stored for long. Removing the bone saves storage space but boned cuts should be trimmed and tied or sewed into compact roasts before freezing.

The chilled cuts should be packaged in tight containers or wrapped closely and carefully with tough, moisture-proof parchment paper to prevent or delay the drying of the meat during freezer storage. Cheap oiled paper or ordinary wrapping paper is not satisfactory. Two sheets of parchment between the steaks or chops that are wrapped together will permit the removal of one or more of them from a bundle without thawing.

Freezing and Storing

The wrapped labeled fresh meat is spread in the small sharp freezer so that it will freeze quickly. When the packages of fresh chilled meat are

piled together in the locker it is often several days before the center of the pack reaches the desired temperature. Some spoilage and some off flavors have been reported when the meat was piled to freeze.

Ten degrees below zero F. is generally accepted as the preferred temperature for the "sharp" freezing of foods. At this level freezing is comparatively rapid, the enzymes are less active, and the evaporation of the surface ice from the meat (freezer burn) is relatively slow. Zero is the preferred temperature for the locker rooms but 10° above zero is often used where zero is not practical and is generally satisfactory. Temperatures above 10° for freezer storage are not recommended because of increased activity of the enzymes and more rapid dehydration. Some molds will grow at temperatures around or slightly above 15°.

A high relative humidity in the storage room is desirable to prevent excessive drying of the products. The control of humidity in a freezer is so difficult, however, that protection of the meat by effective wrapping or packaging is usually substituted.

Time in storage is the greatest enemy of properly handled frozen meat. The longer the storage period the greater the opportunity for the enzymes and drying to produce undesirable changes. If proper temperatures and methods for freezing and packaging are not available in the locker unit serving a community, patrons should be especially careful to hold storage periods to a minimum.

Well-fattened beef, lamb, and poultry appear to stand freezer storage better than the thinner meat, sometimes being kept for as long as a year. Fresh pork, under the present methods of wrapping, does not give the satisfaction obtained from beef and lamb when stored for several months. Periodic slaughter of hogs so that the pork is not held in storage for over three or four months will lessen the danger of the fat becoming strong or rancid. Cooperation with one or more neighbors in the periodic dressing and joint use of a beef reduces the storage time, permits renewing the meat supply just previous to a rush period such as harvest, and increases the amount of meat that can be handled through a single locker annually.

Smoked pork is often stored in freezers to prevent mold growth and infestation by insects. The freezing of this product would seem an unnecessary expense except under special conditions. Sausage is usually ground and frozen without seasoning. The salt and fresh, aromatic spices are added after thawing. Ground meat is reported less suited to prolonged freezer storage than unground.

Thawing and Handling Frozen Meat

Frozen meat can be cooked without thawing though somewhat more time is needed, particularly for the larger pieces cooked in an oven or boiled. If the meat is to be thawed before cooking, thawing in a household refrigerator is recommended and the thawed meat can normally be held in the refrigerator for a day or two, if necessary, without cooking. Thawing and thawed meat is always wet and offers an ideal medium for the development of bacteria, molds, and yeasts that are present on the surface. For this reason thawed meat should be handled carefully and, if it is thawed outside the refrigerator,

cooked immediately. It has been observed that families possessing a household refrigerator use a freezer locker to the best advantage. The household box supplements the locker.

Combination household refrigerators and freezers are on the market with freezing compartments varying in capacity from one-half cubic foot to six or eight cubic feet. Larger home-made insulated boxes for similar use on larger and specialized farms, plantations, or ranches have been designed and tested by the Washington State College. The familiar ice cream storage cabinet, the six-member cooperative community chill room pioneered by T.V.A., and the large meat curing houses of the South are all additional examples of ways in which refrigeration is being made more readily available to the family that is trying to produce and preserve its own food supply. Each type of cooling or freezing equipment has its own special place. The central locker is probably the cheapest source of freezing temperatures. It is also the least convenient. To be used economically and satisfactorily food must be withdrawn from the locker and taken home when some member of the family is making a trip to town on other errands.

Organization and Financing of Locker Unit

Some communities are better adapted to the support of freezer lockers than are others. Communities composed of self-sustaining, diversified, family-size farms connected by good roads to a popular trading center have a large number of potential locker renters. On the other hand, some remote settlements in not especially productive areas have found that those sub-freezing storage temperatures made possible the holding of home-raised surpluses or the keeping of wholesale purchases shipped in from the "outside". About one-third of the rural families are reported to be potential patrons of the lockers, though in some places patronage is almost 100 percent. From 10 to 50 percent of those renting lockers at some plants are town residents, who buy their foods in the country or through the local plant or from local merchants.

The location of a locker unit should be convenient for its patrons. Nearness to other centers of trade or closeness to a popular highway is always desirable. Heavy adjacent traffic and absence of parking space is an inconvenience to the rural patrons and a definite handicap to the locker organization. Small towns of only a few hundred inhabitants but centered in a good farming country often possess successful and profitable locker units.

A building 30 by 50 feet can house some 300 lockers, which is probably as small a unit as should be operated as an independent business. Some units contain 1,000 or more lockers and some, operated in connection with another business, possess only 50 to 100 lockers.

Ice companies, creameries, cold storage plants, retail meat dealers, and farmers' organizations, both cooperative and otherwise, own and operate these locker units. Sometimes a farm organization will help finance or underwrite with locker subscribers a unit built and operated by a local business man or commercial enterprise. Combining a cold storage locker unit with another business is reported to stimulate that other business.

The cost of a cold storage locker unit will vary widely, depending upon many factors, including the cost of labor and of organization or promo-

tion. Costs are estimated roughly as between \$25 and \$50 per locker, including building, insulation, machinery, and equipment. This cost applies especially to units of 300 or more lockers. Where an existing building can be used or where a compressor and insulated storeroom are already available, as in an ice plant, this cost can be greatly reduced, sometimes by one-half. Some new 300-locker units have been reported which, with a new building and all equipment, including \$4 to \$5 apiece for the steel lockers, cost around \$10,000.

Financing for these cold storage lockers is found locally as a rule. Some cooperative organizations have borrowed money from the Farm Credit Administration. Where the units are of sufficient size, are largely rented, and are properly operated, income appears to be sufficient to pay for operation, interest, insurance, curtailments on the loan, and other expenses. These locker units, however, should not be, and, in the face of current competition, probably cannot be a source of unusual profit to the owners.

Plan of Building

The plan of the building should be such that more storage space can be added easily. The building should include a chill room, with a temperature of about 36° F.; a cutting or work room, sometimes chilled to 55° or below, allowing ample space for slicing, wrapping, and labeling the meat; a small freezer about 6 by 8 feet, with a temperature near 10° below zero; and a locker room, with a temperature of 10° above zero or lower. A pre-cooler or "first room" to receive and chill the steaming, freshly slaughtered carcasses will protect previously chilled meat, in the second or aging room, from undesirable dampness. Whether it is practical to build these two coolers, and, possibly, to include a third one for curing meat will depend on the amount of such business that is to be handled.

A locker room 17 feet wide will hold 40 lockers for every 3 feet 4 inches in length if the lockers are 20 inches wide, 17 inches tall, 30 inches deep, and are erected in stacks of 5. This width of 17 feet permits 6 inches between the stack of lockers and the side wall for air circulation, a 30-inch locker, a 3-foot alley, a 5-foot double stack of lockers, another 3-foot alley, a 30-inch locker against the opposite wall, and 6 inches of space between that last row and the wall.

If it is 9 feet from the surface of the insulated finished floor to the insulated finished ceiling, there will be space in the locker room for coils above the lockers and in the chill room for the hangers and beams necessary to erect steel meat rails 7 1/2 feet above the floor for hanging quarters of beef and average carcasses of hogs with the heads removed. This 7 1/2-foot rail is not high enough to hold a side of beef without the neck and shoulder dragging on the floor.

To provide clearance for quarters of beef the rails should be 2 feet from the wall and 4 feet from each other. Length of rail needed for hanging and chilling freshly slaughtered carcasses will vary from 18 inches for a quarter of a medium-heavy beef to about 14 inches for the carcass of a 200-pound hog hung on a gambrel. After thorough chilling little or no damage results if carcasses touch and they can be hung somewhat closer together.

It is desirable that the rails in the chill room should extend through the cutting room and outside to the receiving platform so that carcasses coming to the plant can be suspended from the rail and moved into cold storage with as little labor and contamination from handling as possible.

If overhead cooling coils with an insulated bunker are to be used in the chill room 11 or 12 feet of head room will be needed to accommodate both the coils and the 7 1/2-foot rail. Other types of cooling units including coils along the wall, shielded by an insulated baffle to direct the air flow, are sometimes substituted for the overhead bunker. The frost that gathers on the coils partially insulates them and reduces their efficiency. Some method for defrosting must be provided or space should be left between pipes and between them and the wall so that the ice can be scraped or knocked off frequently. Refrigeration equipment should be selected before the final dimensions of the building are determined.

The arrangement of the various rooms with relation to each other must be adapted to local needs. The movement of incoming meat should be normally through or beside the cutting room, to the chill room, from the chill room back into the cutting room, from the cutting room to the small freezer, and from the freezer to the lockers. Some managers have arranged their layout so that all patrons coming to the locker room to take out packages must pass through or within sight of the cutting room. This gives the operator of the plant, who is working in the cutting room, a chance to check people going in and out and makes it convenient for him to receive for freezing any small packages of poultry, fish, game, or other products that thoughtless patrons might otherwise have carried into their lockers where it would have frozen slowly, warmed the foods adjacent to it, and possibly added odor and drip to the products stored in neighboring lockers.

The small freezer, carrying a temperature below zero, should be surrounded and protected by the low temperatures of the main locker room, the chill room, and the cutting room. A vestibule with a set of double doors at the entrance to the locker room serves to protect that room and its contents from the much higher outside temperatures as patrons go in and out.

Construction and Equipment

Substantial construction of the building, particularly of the floor of the locker room, is necessary for obvious reasons. Attention is called to the fact that engineers do not recommend the installation of the floor of a permanent freezer below the level of the ground. Even with excellent insulation there is always a chance that the ground will freeze and heave the foundations of the building.

In designing the building and in the selection and installation of insulation and equipment the assistance of an experienced engineer is recommended. Six inches of properly installed cork board or its equivalent is needed normally for the insulating of freezers. In some cases, however, more insulation may be economical, and, in others, there may be ways in which the insulation cost can be lessened. A 4 by 4 inch automatic ammonia compressor powered by a 7 1/2 horse motor is used satisfactorily in several 300-locker units. There are, however, several different types of refrigerating

units, and technical advice and information are needed to determine which one will be most satisfactory and economical for the particular conditions under which it is to operate. Too much emphasis cannot be laid on the importance of buying a refrigerating system of the type and efficiency that will give the most lasting and economical service. In this connection it should be remembered that temperature variations of more than two degrees above or below the required level are not desirable, and less variation than that can often be obtained. Excessive air circulation in the locker room may result in excessive drying of the meat.

The finish on the walls and floors of work room, chill room, and freezers should be such as to be easily cleaned. Difficulties with mold, spoilage, and off-flavors in food products are less probable if the whole unit can be and is kept in a sanitary condition. An attractive appearance is also a good advertisement. Insulating material, paints, and other finishes and equipment should be of a kind that will not impart odors to the meat.

A reception room or combined reception room and office with conveniences for the patrons and help, and a machine room for the compressor or the compressor and steam boiler, if one is used, complete the essential parts of a locker unit. If vegetables and fruits are to be prepared for freezing at the plant, space and equipment for washing, blanching, and packing should be provided. Directions for the preparation and storage of vegetables and fruits are available from the Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, D. C.

A power grinder for making sausage, ground beef, etc., is normally installed in the cutting room. If lard is to be rendered, the cutting room and coolers should be protected from the heat and moisture of the steam-jacketed kettles. Slaughtering equipment, if included, should be located with especial care to insure the separation of the trucking and slaughtering of live animals from the traffic of patrons coming with or for their meat.

The selection of blocks, tables, tools, lockers, etc., that are easily cleaned is desirable for the same reasons as those mentioned for the wall finish. The lockers, whether home-made or bought, should be set up in stacks or with some other knock-down construction that will permit their removal for periodic cleaning and scalding. Lockers should be theft-proof.

The selection of the proper moisture-proof paper for wrapping meat to protect it from drying (freezer burn) during storage is important. Most of the standard paper companies have special freezer wraps which they will describe and recommend.

Service Rules

The service given by the locker management varies in accordance with local needs but the rules and the charges should be well advertised. Some of the questions and costs to be decided are: (1) Can the farmer dress his own animal at home, can he have a butcher come out from the plant to dress it, or will the plant or some local butcher kill it if the owner hauls it in? (2) Can the farmer bring in a warm carcass for chilling and aging and come in later to cut and wrap it himself or is all cutting and wrapping as well as

freezing done, for a charge, by the management? (3) What disposition is to be made of hide and edible offal and of the cutting trimmings that the plant does not grind or render, and how soon must the owner call for these parts? (4) Does the owner receive an itemized inventory of the numbered labeled packages put in his locker or how is he assured that none of his meat was lost? (5) Can a person sell or buy a carcass through the locker management and what is the difference, if any, in the charge? (6) What days and hours is the plant open so that patrons can come to their lockers? (7) Can small packages of meat or fruits, vegetables, etc., be put in the lockers without suitable preparation and freezing and if not what method must be used? (8) Who replaces a lost locker key and what is the cost? (9) If there are peak seasons when products come in faster than the chilling and cutting rooms can handle them, how does a customer establish his turn? (10) What type of contract between operator and renter should be signed? (11) If lockers are rented only by the year can a patron rent an extra locker for a month or so? (12) Can barreled foods or whole carcasses be put in bulk storage at temperatures either above or below freezing?

Operating Costs and Charges

Items of expense for a freezer locker unit will vary widely but may be roughly listed as follows for a 300-locker unit: power and water bills have been reported from \$40 to \$120 per month, with a probable average of around \$70 to \$80; labor, one good man, with occasional help, to handle the machinery, cut the meat, and receive and assist the patrons; paper, ammonia, oil, and miscellaneous; depreciation, interest, taxes, repairs, and insurance. Locker owners should give consideration to the possibility of a fire or of a breakdown of their power line or compressor, with resulting spoilage of meat, and establish some policy or protection for themselves and patrons that would care for such a loss, should it occur.

Rental charges for lockers vary from about \$7 to \$12 a year, depending partially on the size of the locker itself. Ten dollars is the customary charge. Charges by the management for chilling, cutting, and wrapping the meat have varied from three-fourths of a cent to 1 1/2 cents a pound; 1 1/4 cents is about the customary charge. One plant proposes to make a flat charge of \$20 per locker a year with no charge for cutting. This about averages with the other cost as it is estimated that 700 to 800 pounds of meat is put through each locker annually. Charges for grinding meat and making sausage are about 2 cents a pound; for rendering lard, 2 1/2 cents a pound on weight of rendered lard; and for buying meat carcasses, 2 cents a pound. Slaughter charges range from \$2.50 per head for cattle dressed on the farm to 4 cents a head for poultry. Fruits and vegetables are frozen for about 1 cent a pound. Total income for the plant from these service charges will normally approximate the sum derived from locker rentals.

Inspection

Inspection of the meat handled through these freezer lockers or of the manner in which the units are constructed and operated is largely absent. A license is required in Iowa, costing \$25.00 a year, but it is enforced under an old law that was written before many current problems of cold storage locker management and sanitation existed. Already, however, there is definite

talk about inspection in several states. The community effort to store food and to dress, cut, and use locally-grown meat would seem to make practical some sort of community inspection service. Perhaps these freezers will advance the day when efficient veterinary inspection can also be available, at moderate cost, for farm or country-dressed meat.

The service that freezer lockers can give their patrons depends on their capacity to provide those families with an ample, varied, palatable, and economical diet at all seasons. Clean, sanitary, well-operated plants will be an asset to the family that tries to feed itself on home-raised foods. The family must remember, however, that the proper temperature is the chief commodity that the locker plant has to sell and the chief thing that they need to buy. Dressing the animal, grinding the sausage, and rendering the lard are jobs which the family can do themselves. Buying that service is the easiest but not the cheapest way. Economy for the patrons and permanent satisfied patronage for the management would seem to depend not on duplicating services already available but on supplying suitable controlled temperatures in a new and more usable way.

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